

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** Uvod v algoritme  
**Course title:** Introduction to Algorithms

<b>Študijski program in stopnja</b> Study programme and level	<b>Študijska smer</b> Study field	<b>Letnik</b> Academic year	<b>Semester</b> Semester
Razvoj videoiger in razširjenih resničnosti, visokošolski strokovni študijski program prve stopnje	-	Prvi	Prvi
Game and Extended Reality Development, first cycle Professional Study Programme	-	First	First

**Vrsta predmeta / Course type**

Obvezni / Obligatory

**Univerzitetna koda predmeta / University course code:**

4-RVRR-VS-UVA-2025-02-27

<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike študija</b>	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
30	-	45	-	-	105	6

**Nosilec predmeta / Lecturer:** prof. dr. Biljana Mileva Boshkoska

**Jeziki / Languages:**

**Predavanja / Lectures:** Slovenski / Slovenian, Angleški / English

**Vaje / Tutorial:** Slovenski / Slovenian, Angleški / English

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Pogoj za vključitev v delo je vpis v 1. letnik študija, ustrežna prisotnost na vajah in zagovarjana seminarska naloga.

**Prerequisites:**

Enrolment into the first year of the study programme, appropriate presence during the lab work and finished student project.

**Vsebina:**

**Content (Syllabus outline):**

### Vloga algoritmov v računalništvu

- Pregled algoritmov in njihovo mesto v sodobnih računalniških sistemih.
- Definicija algoritma in primeri.
- Algoritmi kot tehnologija (njihova uporaba v strojni opremi, grafičnih uporabniških vmesnikih, objektno orientiranih sistemih in omrežjih).

### Uvedba osnovnih algoritemskih pristopov v psevdo jeziku

- Določitev vhodov in izhodov v algoritmu.
- Zanke (for zanke, while zanke).
- If then pravila odločanja.

### Predstavitev osnovnih podatkovnih struktur, operacije in algoritmov za delo z njimi

- Tabele.
- Seznami.
- Skladi.
- Kopice.
- Hash tabele.
- Binarna drvesa.

### Predstavitev funkcij preko algoritmov

- Prvi algoritem, ki rešuje problem sortiranja zaporedja od  $n$  števil z uporabo psevdokoda.
- Definiranje strukture algoritma, tako da ga lahko študent/študentka uporabi v jeziku po svoji izbiri.
- Uvod v tehnike iskanja: Linearno, binarno in interpolacijsko iskanje, razprčeno izkanje.
- Dva različna tipa algoritmov za sortiranje (razvrščanje): pojasnjuje postopen pristop s pomočjo vstavitve vrste in rekurzivna tehnika z zlivanjem, "deli in vladaj". Drugi algoritmi za sortiranje: sortiranje z izbiranjem, Shellovo razvrščanje, hitro razvrščanje.
- Naučiti se, kako izračunati čas izvršitve algoritmov, ko se vrednost  $n$  povečuje.
- Razviti koristen zapis, ki izrazi časovno izvedbo algoritmov.

### The Role of Algorithms in Computing

- Overview of algorithms and their place in modern computing systems.
- Definition of algorithm and examples.
- Algorithms as technology (their usage in hardware, graphical user interfaces, object-oriented systems, and networks).

### Introduction of basic algorithmic approaches in pseudo language

- Define inputs and outputs in the algorithm.
- Loops (for loops, while loops).
- If then decision rules.

### Introduction of basic data structures, operations and algorithms with:

- Tables.
- Lists.
- Stacks.
- Heaps.
- Hash Tables.
- Binary Trees.

### Function representation and their growth with algorithms

- A first algorithm that solves the problem of sorting a sequence of  $n$  numbers using pseudocode.
- Explaining the structure of the algorithm so that a student can implement it in the language of his/hers choice.
- Introduction to searching algorithms: linear search, binary search, interpolation search, hash search.
- Different sorting algorithms: explaining the incremental approach through insertion sort, and a recursive technique through merge sort, "divide and conquer." Other covered sorting algorithms: selection sort, Shell sort, quick sort.
- Learn how to calculate the execution time of the algorithms when the value of  $n$  increases, Develop a useful notation to express the time execution of algorithms.

## Temeljni literatura in viri / Readings:

- Cormen, T. H., Leiserson, C. E., Rivest, R. L. & Stein, C. (2022). *Introduction to Algorithms* (4th ed). The MIT Press.
- Liang, Y. Daniel (2022). *Introduction to Python Programming and Data Structures* (3rd ed.). Pearson.
- Cormen, Thomas H. (2013) *Algorithms Unlocked*. IT Press
- Knuth, D. (1997). *The Art of Computer Programming, Volume 1, Fundamental Algorithms* (3rd ed.). Addison Wesley Longman Publishing Co., Inc.

### Cilji in kompetence:

*Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:*

#### Splošne kompetence:

- Sposobnost analitičnega in algoritmičnega razmišljanja.
- Sposobnost fleksibilne uporabe znanja v praksi.

#### Predmetno-specifične kompetence:

- Poznavanje osnovnih podatkovnih struktur in računalniških algoritmov.
- Sposobnost samostojnega reševanja realnih problemov z uporabo primernih podatkovnih struktur in algoritmov.

### Objectives and competences:

*The instructional unit contributes to the development of the following general and subject-specific competences:*

#### General competences:

- Ability of analytical and algorithmic thinking.
- Ability of flexible usage of knowledge in practice.

#### Subject-specific competences:

- Familiarity with basic data structures and computer algorithms.
- Ability to independently solve real problems by using adequate data structures and algorithms.

### Predvideni študijski rezultati:

Znanje in razumevanje:

#### Študent/študentka:

- Razvije sposobnost logičnega razmišljanja in reševanja problemov z uporabo standardnih podatkovnih struktur in algoritmov.

### Intended learning outcomes:

Knowledge and understanding:

#### The student:

- Develops the ability of logical thinking and problem solving with the use of standard data structures and algorithms.

### Metode poučevanja in učenja:

- Predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov).
- Vaje, kjer bodo študentje na konkretnih problemih ponovili, utrdili in dodatno osvetlili pojme in metode, spoznane na predavanjih.

### Learning and teaching methods:

- Lectures with active student participation (explanation, discussion, questions, examples, problem solving).
- Lab work, during which the students will use practical problems to repeat and strengthen the topics and methods presented at the lectures.

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Način (pisni izpit, ustno izpraševanje, naloge, projekt): <ul style="list-style-type: none"> <li>• pisni izpit</li> </ul>	100	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> <li>• written exam</li> </ul>

**Reference nosilca / Lecturer's references:**

- ANDONOVIKJ, Viktor, BOŠKOSKI, Pavle, DŽEROSKI, Sašo, BOSHKOSKA, Biljana Mileva. Survival analysis as semi-supervised multi-target regression for time-to-employment prediction using oblique predictive clustering trees. Expert systems with applications. 2024, [article no.] 121246, vol. 235, str. 1-11, ilustr. ISSN 1873-6793. DOI: 10.1016/j.eswa.2023.121246.
- BOSKOSKI, Pavle, REDEK, Tjaša, PERNE, Matija, BOSHKOSKA, Biljana Mileva. Career path discovery through bipartite graphs. Journal of decision systems. 2024. ISSN 2116-7052. DOI: 10.1080/12460125.2024.2354585.
- TOLIC, Antonio, BOSHKOSKA, Biljana Mileva, SKANSI, Sandro. Chrono Initialized LSTM Networks With Layer Normalization. IEEE access. 16 Aug. 2024, vol. 12, str. 115219-115236, ilustr. ISSN 2169-3536. DOI: 10.1109/ACCESS.2024.3445329.
- ZHAO, Guoqing, LIU, Shaofeng, LOPEZ, Carmen, LU, Haiyan, ELGUETA, Sebastian, CHEN, Huilan, MILEVA BOSHKOSKA, Biljana. Blockchain technology in agri-food value chain management : a synthesis of applications, challenges and future research directions. Computers in industry, ISSN 0166-3615. [Print ed.], 2019, vol. 109, str. 83-99.
- MILEVA BOSHKOSKA, Biljana, LIU, Shaofeng, ZHAO, Guoqing, FERNANDEZ, Alejandro, GAMBOA, Susana, PINO, Mariana del, ZARATÉ, Pascale, HERNANDÉZ, Jorge, CHEN, Huilan. A decision support system for evaluation of the knowledge sharing crossing boundaries in agri-food value chains. Computers in industry, ISSN 0166-3615. [Print ed.], 2019, vol. 110, str. 64-80.